Modeling Mitosis

**How do cells make more of themselves?**

You may have seen fruit flies buzzing around a bowl of fruit. They are tiny, but if you look closely you may see red or white eyes. Like all living organisms, fruit flies grow. Growth occurs when cells reproduce or make copies of themselves. Mitosis is the process by which a cell divides into two daughter cells, each of which has the same number of chromosomes as the original cell. In this investigation you will simulate mitosis in fruit flies.



**Materials**

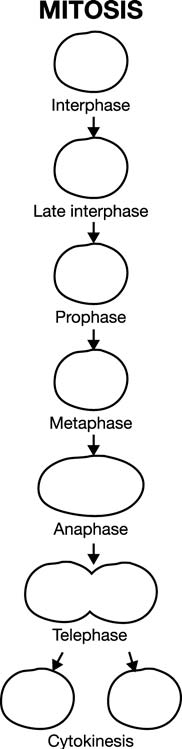
• Large piece of construction paper

• 16 pipe cleaners of 2 different colors and 4 matching lengths

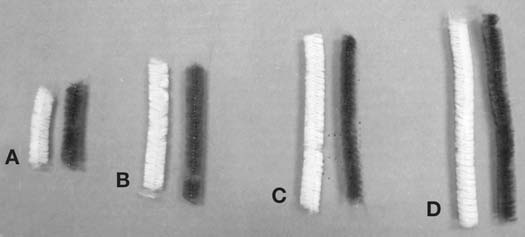
• O-shaped cereal

• Marker

**Procedure**



1. Copy the chart (right) onto a piece of large piece of construction. The circles represent a fruit fly **body cell** in **different stages of the cell cycle and mitosis**.
2. Get a set of **pipe cleaners** to represent **chromosomes**. One color will represent the mother and the other color will represent the father. Chromosomes occur in homologous pairs (homologous means having a similar structure). So use the same length of pipe cleaner for each homologous pair. You should have two sets of four different lengths of pipe cleaners.
3. Begin by assembling a diploid set of chromosomes for a fruit fly as they exist during most of interphase (step 1 on the board). A **diploid set** contains **pairs of homologous chromosomes**. Each chromosome at this point will be a single strand. You will have an extra set of each length and color left over. Here is a diploid set:

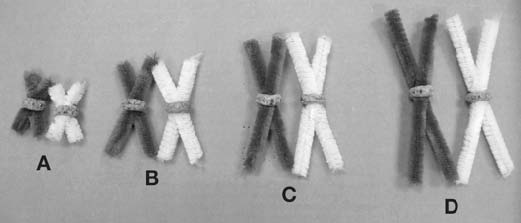


1. What is the **diploid number of chromosomes** in a fruit fly? \_\_\_\_\_\_\_\_\_\_\_
2. How many **homologous pairs of chromosomes** does a fruit fly have? \_\_\_\_\_
3. In the diagram (right), name the steps that are part of **mitosis**. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Which steps are parts of the **rest of the cell cycle**?

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**Modeling mitosis**

1. In late interphase (step 2 on your board), the amount of DNA doubles. That means each chromosome now doubles. Select a matching pipe cleaner (same length and color) for each chromosome and slide both through a piece of cereal. You now should have a set of eight doubled chromosomes arranged in homologous pairs.
2. Review the mitosis diagram in your textbook and move the chromosomes through the rest of the steps on your board.



1. Explain the process to your table partner.
2. Fill in Table 1 with the correct information.

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Number of cells** | **Number of chromosomes** | **Number of homologous** |
|  |  | **in each nucleus** | **pairs in each nucleus** |
| **Interphase** |  |  |  |
| **Cytokinesis** |  |  |  |

**Table 1: Cell cycle and mitosis in fruit flies**

1. What is the purpose of mitosis?

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1. A diploid set of human chromosomes contains 23 homologous pairs (46 chromosomes). Fill in Table 2 with the correction information regarding human body cells.

**Table 2: Cell cycle and mitosis in humans**

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Number of cells** | **Number of chromosomes in** | **Number of homologous** |
|  |  | **each nucleus** | **pairs in each nucleus** |
| **Interphase** |  |  |  |
| **Cytokinesis** |  |  |  |

1. Why is it necessary to double the amount of genetic material before mitosis begins?

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1. The two daughter cells end up with an exact copy of the genetic material from the parent cell. How does your simulation support this statement?

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Modeling Mitosis Answers

1. What is the diploid number of chromosomes in a fruit fly? 8
2. How many homologous pairs of chromosomes does a fruit fly have? 4
3. In the diagram (right), name the steps that are part of **mitosis**.

Prophase, Metaphase, Anaphase, and Telophase

1. Which steps are parts of the rest of the cell cycle?

Interphase and Cytokinesis

1. Fill in Table 1 with the correct information.

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Number of cells** | **Number of chromosomes** | **Number of homologous** |
|  |  | **in each nucleus** | **pairs in each nucleus** |
| Interphase | 1 | 8 | 4 |
| Cytokinesis | 2 | 8 | 4 |

**Table 1: Cell cycle and mitosis in fruit flies**

1. What is the purpose of mitosis?

Cell division, replacement of worn out cells

1. A diploid set of human chromosomes contains 23 homologous pairs (46 chromosomes). Fill in Table 2 with the correction information regarding human body cells.

**Table 2: Cell cycle and mitosis in humans**

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Number of cells** | **Number of chromosomes in** | **Number of homologous** |
|  |  | **each nucleus** | **pairs in each nucleus** |
| **Interphase** | 1 | 46 | 23 |
| **Cytokinesis** | 2 | 46 | 23 |

1. Why is it necessary to double the amount of genetic material before mitosis begins?

So both daughter cells end up with complete sets of chromosomes after division.

1. The two daughter cells end up with an exact copy of the genetic material from the parent cell. How does your simulation support this statement?

At cytokinesis there are two cells, each with complete nucleus.